Free and not so free: Dialect variation and quantity-quality interactions in Welsh vowels

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Dialect variation and quantity-quality interactions in Welsh vowels

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1 Length and quality in Welsh vowels

1.1 The old problem

The received view

- Descriptions: two classes of vowels
- Mutually predictable distribution of length and quality
  - Long vowels = tense [iː uː eː oː]
  - Short vowels = lax [ə ɪ ʊ ɛ ɔ]
  - Disagreement about [a]/[ɑː]

For discussion, see Watkins (1967), G. E. Jones (1984), Awbery (1986), Ball & Williams (2001), Wmffre (2003), Mayr & Davies (2011)

The evidence: quality is phonemic

- English borrowings like ['brɔːn] *brawn*: length does not predictably lead to tenseness
  - ☞ Unclear status in the grammar
  - ☞ Not empirically shown that borrowed [ɛː ɔː] qualitatively identical to native [ɛ ɔ]
  - ☞ Unclear if [a]/[aː] are distinct qualitatively, maybe dialect variation?
- Difficult to account for patterning

The evidence: quantity is phonemic

- Predictable distribution within 'short-long' or 'lax-tense' pairs (Awbery 1984)
  - Long before [b d g f θ χ v ð]
  - Short before (most) clusters (but always predictable in any case)

- Short before [p t k s ʃ ɬ m ŋ]
- [ə] is always short
- Lexical contrast before [n l r]

(1) South Welsh

a.	[ˈtʰoˑnɛ]	*tonau*	‘tunes’
b.	[ˈtʰɔnˑɛ]	*tonnau*	‘waves’

Dialect variation in length

- All dialects: long and short vowels in stressed monosyllables

☞ *ton* ‘wave’ [ˈtʰɔnˑ] ≠ *tôn* [ˈtʰoːn] ‘tune’

- South Welsh: long and short vowels in stressed penults

☞ [ˈtʰɔnˑɛ] *tonnau* ‘waves’ ≠ [ˈtʰoˑnɛ] *tonau* ‘tunes’

- North Welsh: only short vowels in penults

☞ [ˈtʰɔnˑa] *tonnau* = [ˈtʰɔnˑa] *tonau*

- Mid Welsh and NE (Awbery 1984): ‘free variation’ in penults

- Partially predictable distribution of quantity driven by quality of surrounding vowels: mix of coerced and distinctive weight (Morén 2001)
- Analysis: general bimoraicity requirement moderated by lexical moraicity and constraints on what can and can’t acquire a mora

(2) North Welsh: all vowels short, no lengthening: undominated DepLink-μ [V]

		DepLink-μ [V]	Stress-to-Weight	DepLink-μ [C]
/ɬian/	a. ☞ [ˈɬi$_{\mu}$an]		*	
	b. [ˈɬi:$_{\mu\mu}$an]	*!		
/agor/	c. [ˈa$_{\mu}$gor]		*!	
	d. [ˈaː$_{\mu\mu}$gor]	*!		
	e. ☞ [ˈa$_{\mu}$g$_{\mu}$or]			*
/tʰekʰa/	f. [ˈtʰɛ$_{\mu}$kʰa]		*!	
	g. [ˈtʰeː$_{\mu\mu}$kʰa]	*!		
	h. ☞ [ˈtʰɛ$_{\mu}$kʰ$_{\mu}$a]			*
/tʰona/	i. [ˈtʰɔ$_{\mu}$na]		*!	
	j. [ˈtʰoː$_{\mu\mu}$na]	*!		
	k. ☞ [ˈtʰɔ$_{\mu}$n$_{\mu}$a]			*
/tʰon$_{\mu}$a/	l. [ˈtʰɔ$_{\mu}$na]		*!	
	m. ☞ [ˈtʰɔ$_{\mu}$n$_{\mu}$a]			*

(3) Harlech Welsh (Rees 2013): vowel lengthening only if consonant is unavailable

		Stress-to-Weight	DepLink-μ [V]	DepLink-μ [C]
/ɬian/	a. [ˈɬi$_{\mu}$an]	*!		
	b. ☞ [ˈɬi:$_{\mu\mu}$an]		*!	
/agor/	c. [ˈa$_{\mu}$gor]	*!		
	d. [ˈa:$_{\mu\mu}$gor]		*!	
	e. ☞ [ˈa$_{\mu}$g$_{\mu}$or]			*
/tʰekʰa/	f. [ˈtʰɛ$_{\mu}$kʰa]	*!		
	g. [ˈtʰe:$_{\mu\mu}$kʰa]		*!	
	h. ☞ [ˈtʰɛ$_{\mu}$kʰ$_{\mu}$a]			*
/tʰona/	i. [ˈtʰɔ$_{\mu}$ne]	*!		
	j. [ˈtʰo:$_{\mu\mu}$na]		*!	
	k. ☞ [ˈtʰɔ$_{\mu}$n$_{\mu}$a]			*
/tʰon$_{\mu}$a/	l. [ˈtʰɔ$_{\mu}$na]	*!		
	m. ☞ [ˈtʰɔ$_{\mu}$n$_{\mu}$a]			*

(4) South Welsh: vowel lengthening depending on the ranking of the relevant DepLink-μ [C] constraint

		SWP	DepLink-μ [bdgnlr]	DepLink-μ [V]	DepLink-μ [pʰtʰkʰ]
/ɬien/	a. [ˈɬi$_{\mu}$en]	*!			
	b. ☞ [ˈɬi:$_{\mu\mu}$en]			*!	
/agor/	c. [ˈa$_{\mu}$gor]	*!			
	d. ☞ [ˈa:$_{\mu\mu}$gor]			*	
	e. [ˈa$_{\mu}$g$_{\mu}$or]		*!		
/tʰekʰa/	f. [ˈtʰɛ$_{\mu}$kʰa]	*!			
	g. [ˈtʰe:$_{\mu\mu}$kʰa]			*!	
	h. ☞ [ˈtʰɛ$_{\mu}$kʰ$_{\mu}$a]				*
/tʰone/	i. [ˈtʰɔ$_{\mu}$nɛ]	*!			
	j. ☞ [ˈtʰo:$_{\mu\mu}$nɛ]			*	
	k. [ˈtʰɔ$_{\mu}$n$_{\mu}$ɛ]		*!		
/tʰon$_{\mu}$a/	l. [ˈtʰɔ$_{\mu}$nɛ]	*!			
	m. ☞ [ˈtʰɔ$_{\mu}$n$_{\mu}$ɛ]				

Unstressed vowels

- Always short
- Quality depends on position in syllable structure: Pembrokeshire (Awbery 1986)
  - Always tense [i u e o] in hiatus

  - Post-tonic open:
    * Only tense [i u]
    * Free variation for [e/ɛ o/ɔ]
    ☞ Wmffre (2013, p. 36) claims [e o] in final open syllables is a wrong transcription, but no details
  - Post-tonic closed: free variation
  - Pretonic non-hiatus: free variation

1.2 South-West Welsh

A different pattern

- South-West Wales: Pembrokeshire, western Carmarthenshire, (southern) Cardiganshire (Awbery 1986, C. Jones & Thorne 1992, Wmffre 2003)
- Description: mid long vowels are lax before a high vowel

(5) a. [ˈeːdɛ] *edau* ‘thread’
b. [ˈoːgɔv] *ogof* ‘cave’

(6) a. [ˈtʰɛːbɪg] *tebyg* ‘similar’
b. [ˈkʰɔːdi] *codi* ‘rise’

(7) Alternations [ˈkʰoːdɔð] *cododd* ‘((s)he) rose’

- This could be construed along the same lines as the borrowing argument
- But the distribution is still predictable!

Outline of argument

- Are there criteria we can use beyond surface predictability?

☞ Yes: *modularity*

☞ If a distinction participates in a pattern that involves proprietary phonological information, it should be phonological

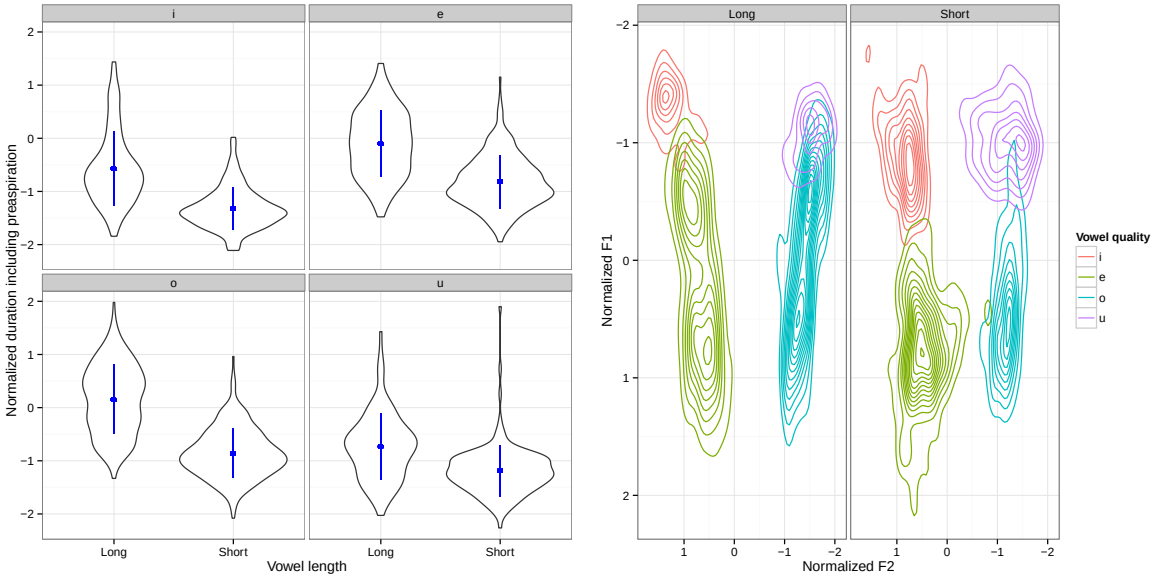
- ‘Tenseness’ is likely phonologized both in SW Welsh and other varieties

2 Dialect variation

2.1 South-West Welsh

Acoustic study

- 8 speakers in study: 6 show the system described for the south-west
- Carmarthen, rural W Carmarthenshire, Pembrokeshire



(a) Vowel duration by category

(b) Vowel quality by vowel length

Figure 1: Duration and vowel quality for south-western speakers

- 149 items × 3 repetitions, controlled for consonantal context, vowel length, height of following vowel
- Carrier phrase *Glywes i'r gair _ ddoe* 'I heard the word _ yesterday'
- Basically: descriptions are correct

To play with the data

```
library(devtools)
devtools::install_github('anghyflawn/llafaR')
library(llafaR)
data(vowels)
```

The acoustic data coming soon at `http://datashare.is.ed.ac.uk`

- Figure 1a: robust durational distinction, as expected for South Welsh
- Figure 1b: clearly bimodal pattern in the mid long vowels but not in high vowels
- 'Lax' long vowels seem fairly similar to short vowels
- Quantitative results: generalized additive hierarchical models using R package `mgcv` (Wood 2006), speaker and word as random effects
- Improved fit with three-way interaction between vowel quality, vowel length and height of following vowel
- In this model, the height of the following vowel has a significant effect (95% CI excludes zero) only on long /eː oː/, again as expected from descriptions

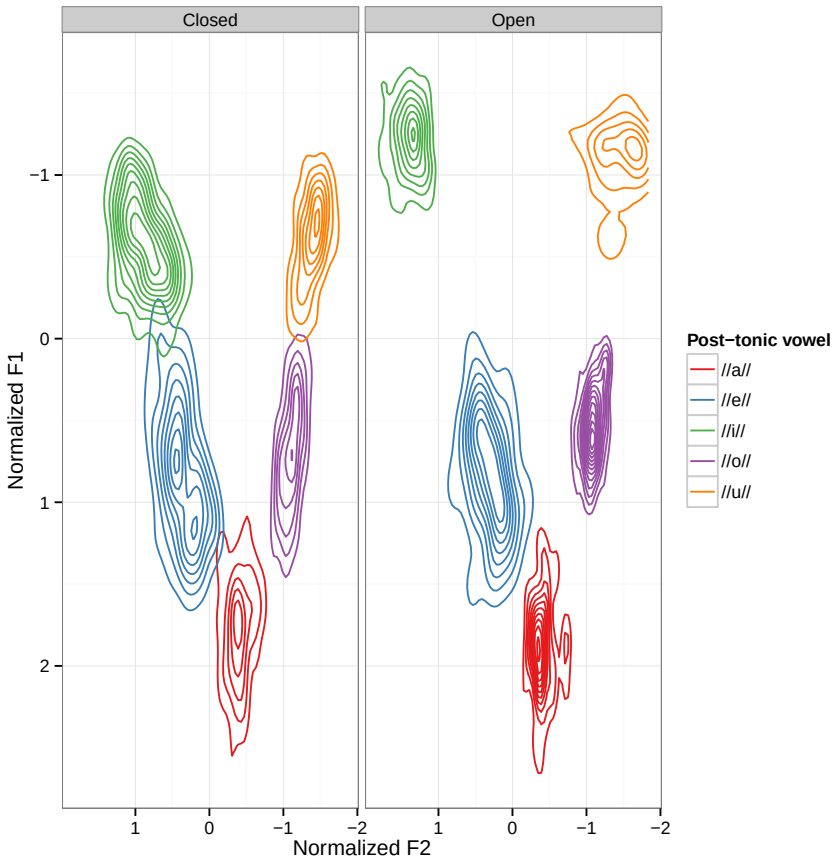


Figure 2: Normalized vowel quality, by final syllable type, south-western speakers

Analysis

- The 'tense-lax' distinction in *mid* vowels is sensitive to the 'high-nonhigh' distinction among *all* vowels
- The height specification of vowels is a proprietary phonological feature

☞ Hence, the 'tense-lax' distinction in mid vowels is phonological

- Emergent/substance-free feature theory (e. g. Mielke 2007, Morén 2007): these two distinctions pattern together, so they are encoded by the same feature

Unstressed vowels

- Tense-lax alternations in high vowels depending on syllable type
- No sign of variation in mid vowels: [ɛ ɔ] only
- Not an undershoot effect (flat regression line even when coda presence is controlled for!)

- Parallel Structures Model of feature geometry (e. g. Morén 2003, 2006, 2007, Youssef 2010)
- Different implementation of 'tenseness' in high and mid vowels

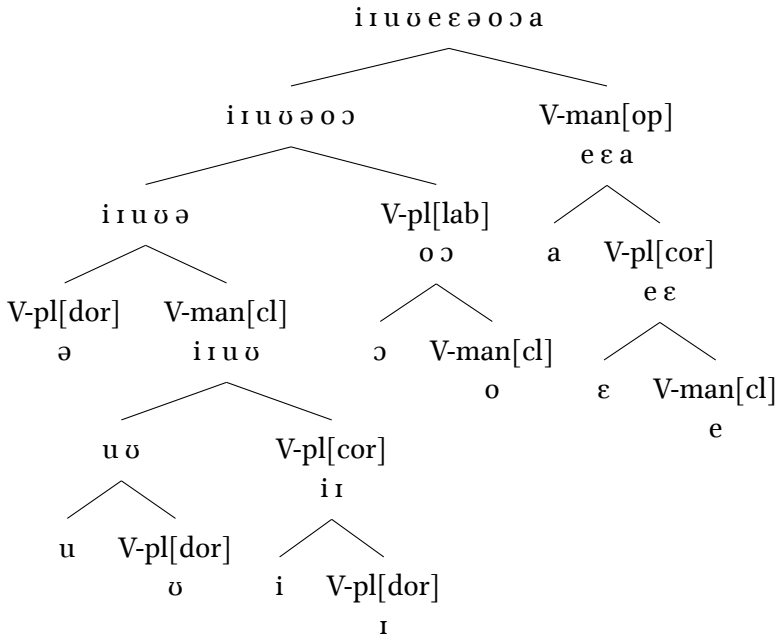
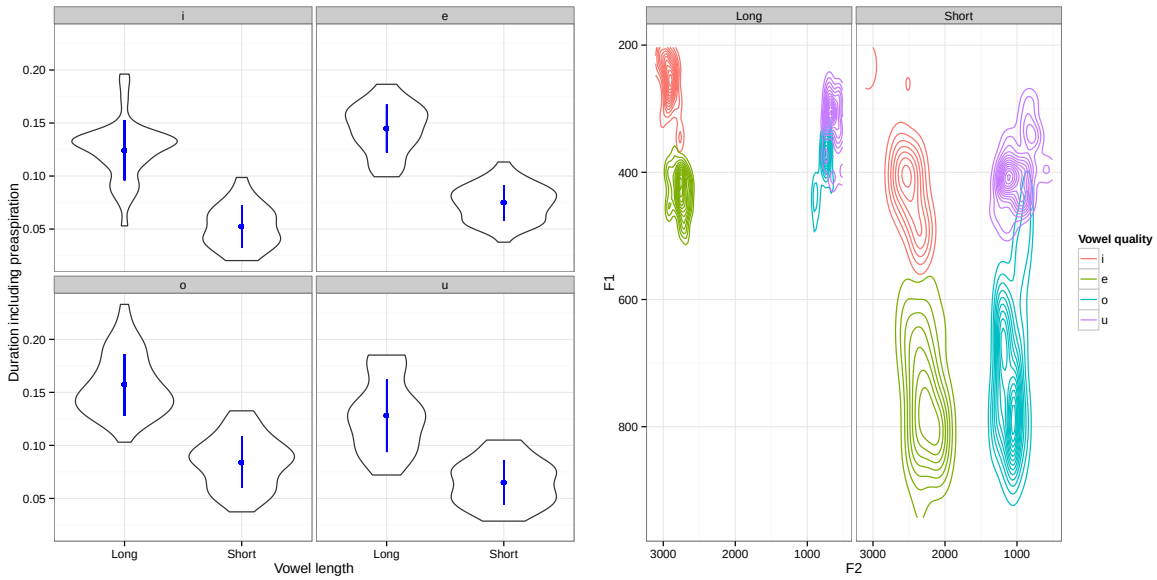


Figure 3: Contrastive hierarchy for South-West Welsh

	V-place			V-manner	
Segment	[coronal]	[labial]	[dorsal]	[open]	[closed]
/i/	✓				✓
/ɪ/	✓		✓		✓
/u/					✓
/ʊ/			✓		✓
/ə/			✓		
/e/	✓			✓	✓
/ɛ/	✓			✓	
/o/		✓			✓
/ɔ/		✓			
/a/				✓	

Table 1: Featural specifications for vowels: South-West Welsh



(a) Vowel duration by category

(b) Vowel quality by vowel length

Figure 4: Duration and vowel quality for Sp1

- High vowels: 'lax' [ɪ ʊ] are more marked
  - Pattern with [ə]: this is the class of vowels that can never be long
  - Tense [i u] can be short
  - Laxness appears in a relatively marked context: closed syllables
- Mid vowels: 'tense' [e o] are more marked
  - Only [ɛ ɔ] in post-tonic syllables
  - Tense [e o] phonologically active: targeted by dissimilation process
  - The feature V-manner[closed] covers both high vowels and tense mid vowels
  - Dissimilation within the final disyllabic domain responsible for alternations

Phonologization in South-West Welsh

- The 'tenseness' distinction shows signs of *phonologization* (Hyman 1976, 2013) or *stabilization* (Bermúdez-Otero & Trousdale 2012, Bermúdez-Otero 2015, Ramsammy 2015): reference to phonological information
  - Distribution in high vowels is sensitive to the presence of a coda
  - Distribution in mid vowels is sensitive to contrastive phonological specification
- Most speakers consistently show unexpected [ɛː] in *ffenestr* ['fɛːnɛst] 'window'
- *Phonemicization*: contrastive by any criterion

2.2 Standard system

- This system is exemplified in the data by a single speaker

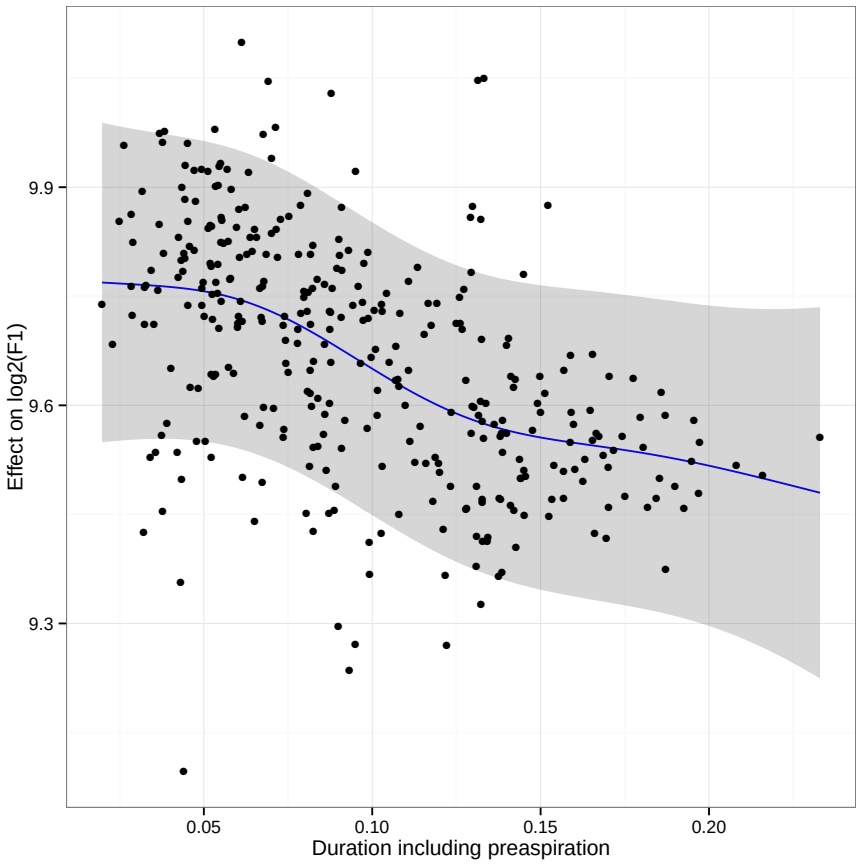


Figure 5: Effect of duration on F1, Sp1

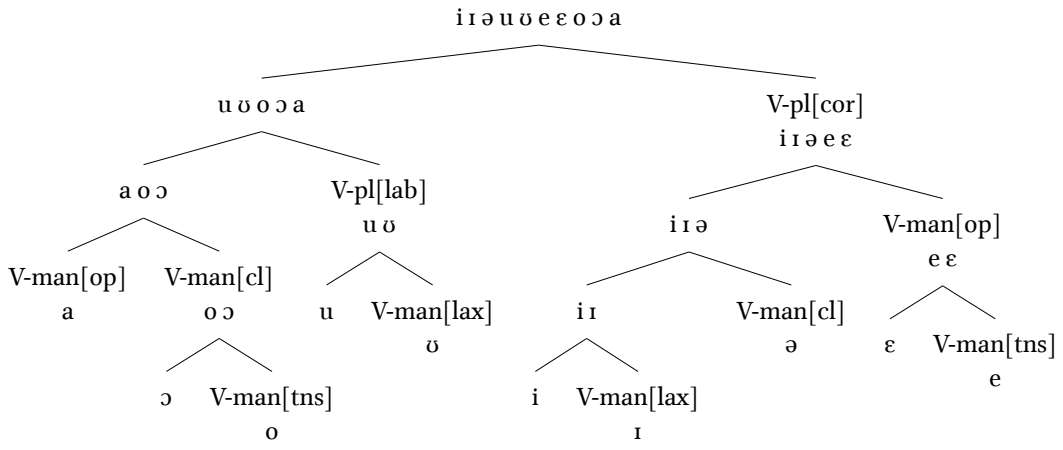


Figure 6: Contrastive hierarchy for the standard system

- Figure 4a: robust distinction in duration
- Figure 4b: 'tense' when long and 'lax' when short
- Similar to findings for monosyllables in Mayr & Davies (2011)
- Figure 5: longer duration gives higher vowels: undershoot towards a high ('tenser') target
- Post-tonic syllables: same picture as in SW!
- Overall distribution:
  - High vowels: lax in closed syllables (unstressed or short before moraic coda), tense in open syllables
  - Mid vowels: lax when monomoraic, tense when bimoraic
- High vowels: lax member is marked
- Mid vowels: tense member is marked
- The specifications in table 2 basically overlay this on the analysis for Welsh vowels in Iosad (2012)

Summary on standard system

- 'Tenseness' probably phonologized: sensitive to phonological information
  - High vowels: presence of codas
  - Mid vowels: moraic structure
  - ☞ Not a duration effect
- The features used for the 'tenseness' distinction do not interact with anything else or with each other
- No evidence this is the same feature in high and mid vowels

2.3 The non-enhanced system

- Single speaker from Aberystwyth

	V-manner				V-place	
Segment	[closed]	[open]	[tense]	[lax]	[labial]	[coronal]
/i/						✓
/ɪ/				✓		✓
/ə/	✓					✓
/u/					✓	
/ʊ/				✓	✓	
/e/		✓	✓			✓
/ɛ/		✓				✓
/o/	✓		✓			
/ɔ/	✓					
/a/		✓				

Table 2: Featural representations for the standard system

- Figure 7a: small but robust difference in duration by vowel category

☞ This *contradicts* the descriptions claiming 'free variation between "short" and "long" vowels'

- Figure 7b: no difference in formant values by length category: all stressed vowels are 'lax'
- Figure 8: shorter vowels are higher: undershoot towards a low target!

☞ No free variation in sight!

- Same post-tonic system as elsewhere

Summary for non-enhanced system

- No evidence for a phonological 'tenseness' distinction in mid vowels
- Some evidence for a distinction in high vowels sensitive to codas, but only apparent word-finally

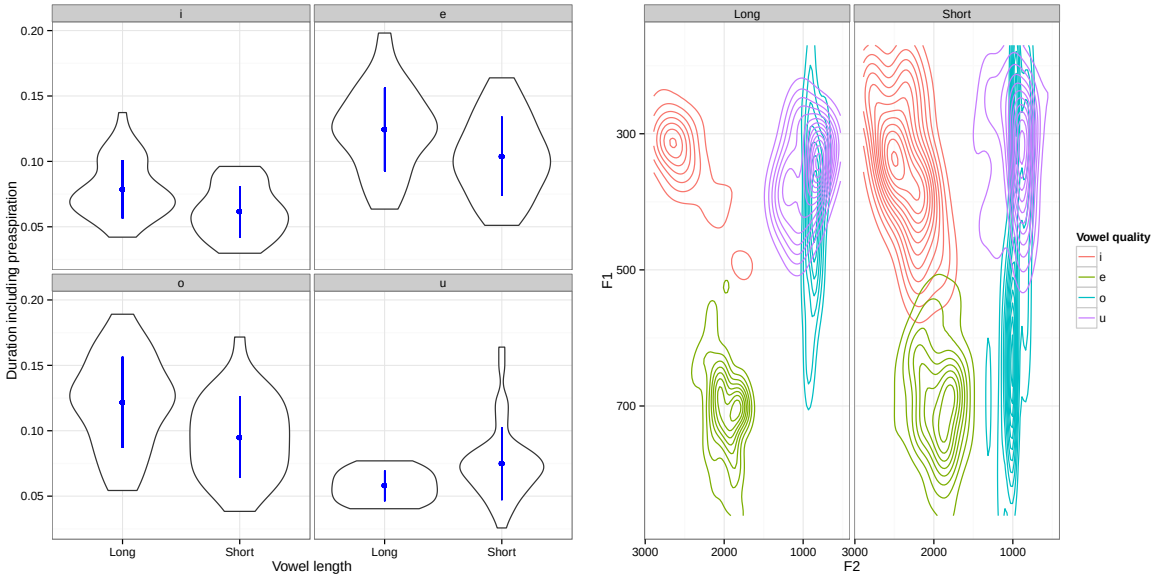
☞ Note the broader domain of the requirement compared to the standard system

- No analysis here due to lack of data from stressed monosyllables
- Potentially: 'free variation' in quantity really means '(some) continuous variation in quality'

3 Phonologization across dialects

3.1 Diachronic interpretation

- Suggested diachronic interpretation for stressed vowels
  0. No difference in quality within vowel categories ≈ non-enhanced system
  1. Length is enhanced by (continuous) tensing (Stevens & Keyser 1989, 2010, Keyser & Stevens 2006) ≈ traces in standard system
  2. All short-long pairs are interpreted as featurally distinct, but the features are inert otherwise ≈ standard system



(a) Vowel duration by category

(b) Vowel quality by vowel length

Figure 7: Duration and vowel quality for Sp8

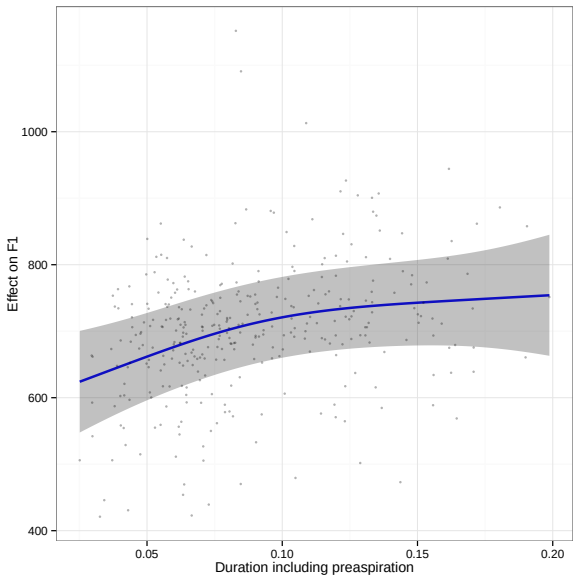


Figure 8: Effect of vowel duration on F1, Sp8

3. Features used for the tenseness distinction participate in alternations involving other segments ≈ south-western system
4. Tenseness becomes phonemicized

- Rees (2013): the trajectory is tensing to lengthening in penults
  - Common North Welsh [ɛ] → Tywyn [ɛ∼e] → [e∼eˑ] → common South Welsh [eˑ]
  - Not the case in the non-enhanced system: [ɛ] vs. [ɛˑ], lengthening precedes tensing
  - ☞ Consonant durations confirm that the qualitative distinction is real
- Wmffre (2003): lax vowels in penults in Mid Wales come from lowering and shortening
- Common Mid Welsh ['keˑvɛn] → innovative ['kɛˑvɛn] → ['kɛvɛn]
  - No evidence of any tense mid vowels in the non-enhanced system
  - Unclear durational implications of the transcriptions (['kɛvˑɛn]?)
- Arguably we expect originally lax quality in penults, as these were short before stress shift

3.2 Rule scattering in South-West Welsh

The origin of height dissimilation

- Height dissimilation: phonologization of a trade-off in inherent length
- Irish: synchronically (Munster; Ó Sé 1989) and diachronically (Connacht; Ó Sé 1984) ⇒ categorical (?)
- East Slavic: categorical (Crosswhite 2000) or continuous (Kasatkina & Ščigel' 1996, Kniazev & Shaulskiy 2007), potentially coexisting
- Kera: continuous? (Pearce 2007)

- The following model was used to estimate the effect of post-tonic vowel duration on the ratio between the duration of the stressed and post-tonic vowel

```
fit <- gam(v1h.v2h.ratio ~ s(v2h.dur, by=v1, k=5) +
         v1 + v1.is.long + s(speaker, bs='re') + s(word, bs='re'),
         data=sw.data)
```

- Figure 9 shows that the relationship is consistent with the existence of a trade-off
- The coexistence of a continuous pattern and its categorical congener in the grammar is major prediction of the theory of the life cycle: *rule scattering*
- South-West Welsh is an interesting example of rule scattering, since the cognate processes are rather different in nature (unlike t/d-deletion, [l]-darkening etc.)

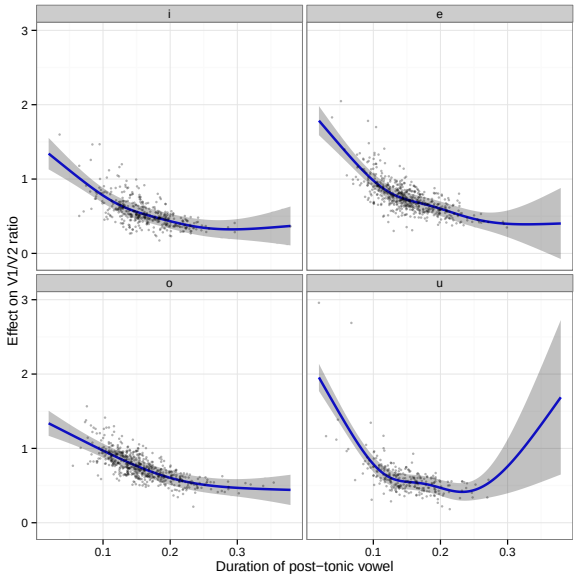


Figure 9: Effect of post-tonic vowel duration on V1/V2 duration ratio, by stressed vowel, south-western speakers

Summary

- Theory
  - Predictability is a less useful criterion for phonological analysis
  - Key to being phonologized is participation in the phonological grammar
- Data
  - More targeted work needed on vowel quality and quantity
  - Transcriptions may not be very reliable, especially with respect to quantity and qualitative variation
  - More work needed: dialect diversity, pretonic syllables, better post-tonic controls, control for phrasal accent (Rees 2013)
- Diachrony: apparently not very much done here yet!

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	No height effect	No interaction	Model with interaction
Intercept	−1.01*	−1.06*	−1.00*
	[−1.24; −0.77]	[−1.29; −0.83]	[−1.18; −0.82]
//ə//	0.71*	0.65*	0.79*
	[0.44; 0.98]	[0.39; 0.90]	[0.57; 1.00]
//e//	1.55*	1.42*	1.58*
	[1.28; 1.82]	[1.17; 1.68]	[1.34; 1.82]
//o//	1.59*	1.50*	1.54*
	[1.26; 1.91]	[1.19; 1.82]	[1.26; 1.81]
//u//	0.26	0.14	0.29
	[−0.09; 0.61]	[−0.20; 0.48]	[−0.04; 0.62]
Long vowel	−0.22	−0.29*	−0.25*
	[−0.50; 0.06]	[−0.55; −0.03]	[−0.47; −0.04]
Long /e/	−0.26	−0.16	−0.83*
	[−0.62; 0.10]	[−0.50; 0.18]	[−1.15; −0.52]
Long /o/	0.00	0.08	−0.38*
	[−0.36; 0.37]	[−0.27; 0.42]	[−0.68; −0.08]
Long /u/	0.34	0.34	0.35
	[−0.10; 0.77]	[−0.07; 0.75]	[−0.16; 0.85]
Duration smooth	1.86	2.37	2.13
	[−2.70; 6.42]	[−3.35; 8.10]	[−3.04; 7.31]
F2 smooth	3.33	3.50	3.79
	[−4.04; 10.70]	[−4.06; 11.05]	[−3.97; 11.56]
Speaker (random)	4.41	4.43	4.35
	[−5.39; 14.21]	[−5.37; 14.23]	[−5.45; 14.15]
Word (random)	98.37	96.29	76.98
	[−117.23; 313.97]	[−119.30; 311.89]	[−122.94; 276.90]
High post-tonic vowel		0.27*	0.05
		[0.15; 0.38]	[−0.27; 0.36]
//e// before high			−0.08
			[−0.47; 0.30]
//o// before high			0.02
			[−0.36; 0.39]
//u// before high			−0.18
			[−0.61; 0.25]
Long vowel before high			0.03
			[−0.35; 0.42]
Long //e// before high			1.06*
			[0.57; 1.54]
Long //o// before high			0.82*
			[0.34; 1.30]
Long //u// before high			0.05
			[−0.60; 0.69]
AIC	2098.91	2091.54	2074.06
BIC	2762.91	2753.46	2672.18
Log Likelihood	-931.50	-928.18	-930.77
R^2	0.79	0.79	0.79

* 0 outside the confidence interval

Table 3: Models for normalized F1, south-western speakers